

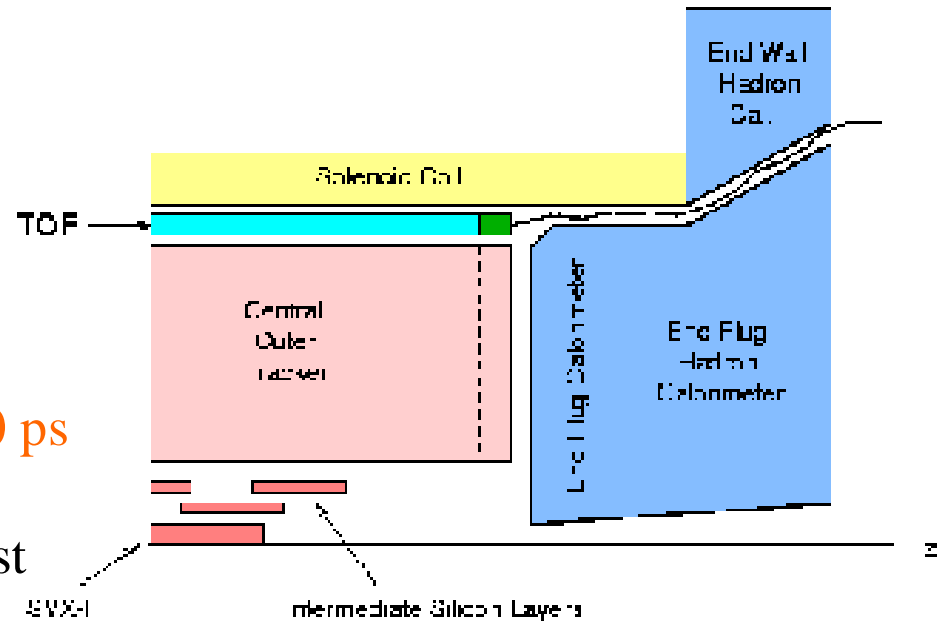
# *Status of the T0F detector*

TOF group( U. Cantabria,FNAL,INFN  
Pisa and Rome, KCHEP,  
MIT,LBNL,U.Penn, U. Tsukuba

- **Hardware**
- **Calibrations**
- **Offline (By Ivan K. Furić)**

# Status of the T0F Detector

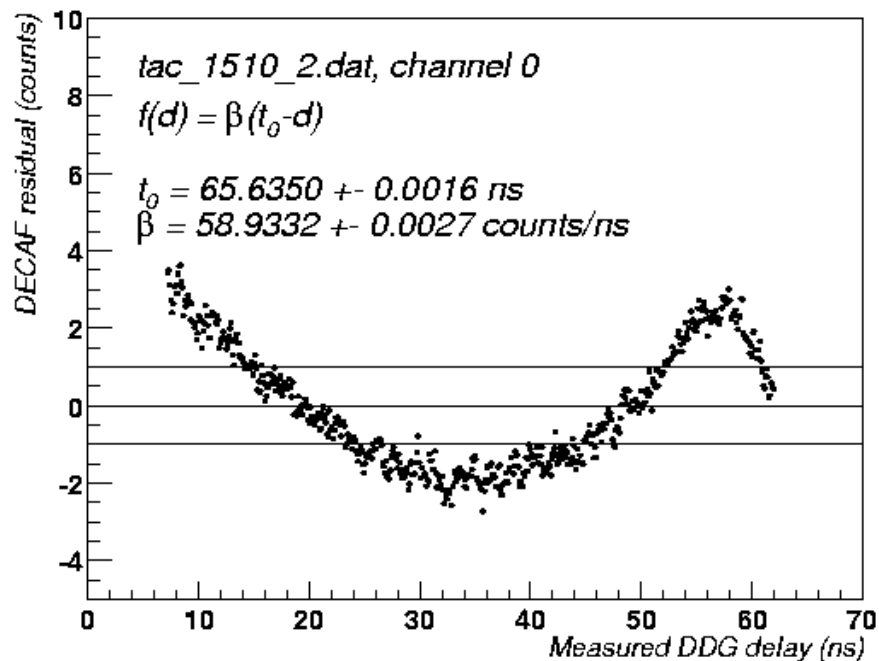
- 216 bars of bicron BC-408 (in 72 triplets)
  - 2.8 m, 4x4 cm<sup>2</sup>
  - Long Att. Length (L~3.2m)
  - Fast Rise-Time (0.9ns)
- Hamamatsu 19-stage, fine-mesh PMT (one at each end of the bars)
  - Operate in 1.4T field
  - Small TTS (250 ns to 400ns)
- Expected resolution at PMT: ~100 ps (Linear dependence : ~0.4ps/cm)
- Installation fully completed August 2001



# Status of T0F detector

- Goal for Electronics  $\sigma_t < 25$  ps
- Front –End Electronics: time (**T**) and pulse heights (**Q**)
  - Start signal from Threshold discriminator
  - Stop signal from clock distribution system
  - Voltage output sampled by 12-bit ADC (DECAF card)
  - Q measured for discriminator walk (time slewing correction)
- 
- **TAC** Calibration:
  - **TAC** response to known delays from digital delay generator, measured.
  - Response is not completely linear ->  $V(t) = \beta(1 + \gamma e^{-(t/\tau)})t$
  - Residual from fit kept below 17 ps with RMS of 4.9 ps
  - Also during this calibration -> Time dependent ADC pedestals are measured.

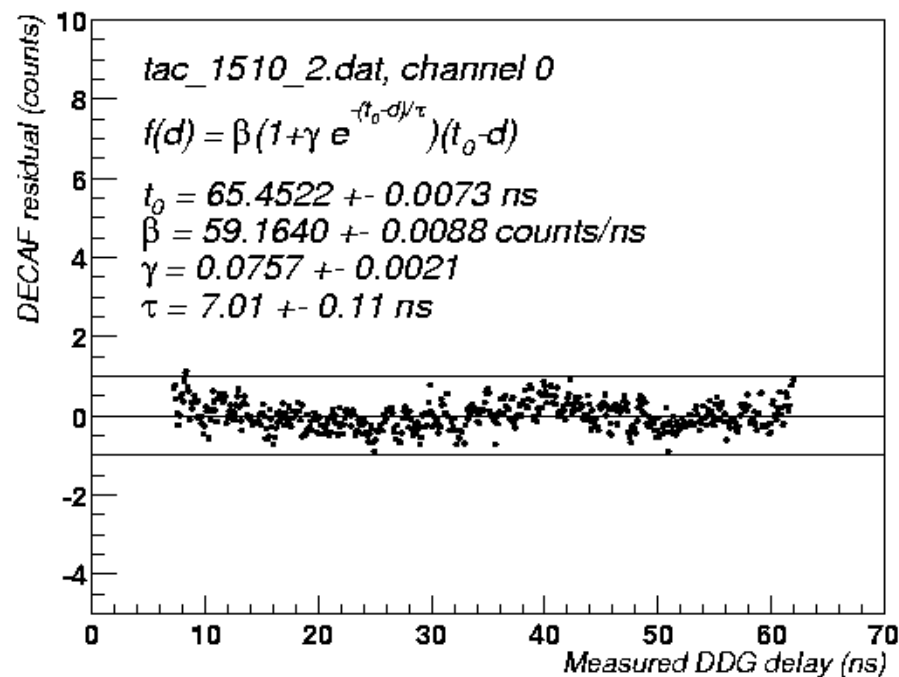
# Status of T0F detector



Assuming a linear response for  
the TAC Calibration

$$f(d) = \beta(t-d)$$

April 4, 2002

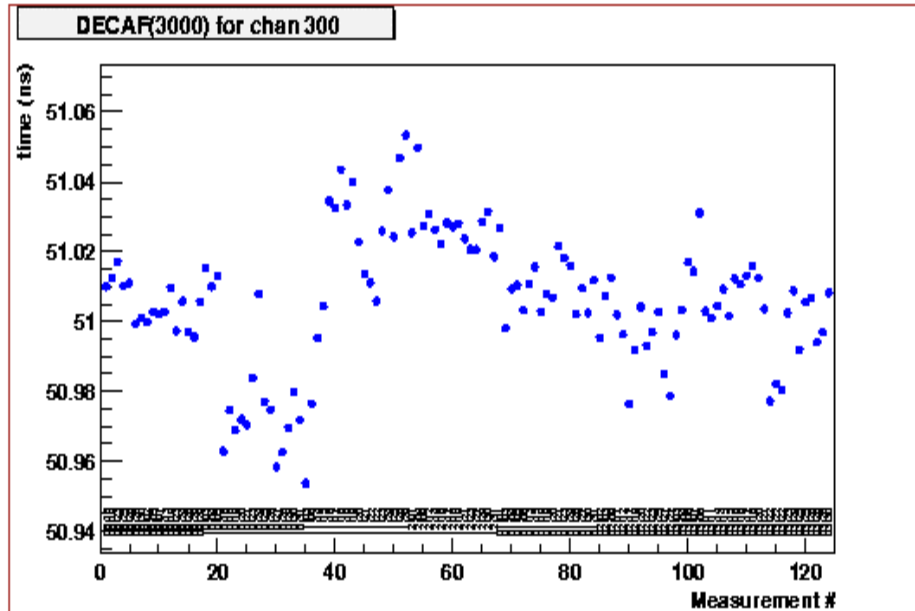


Assuming a non linear response

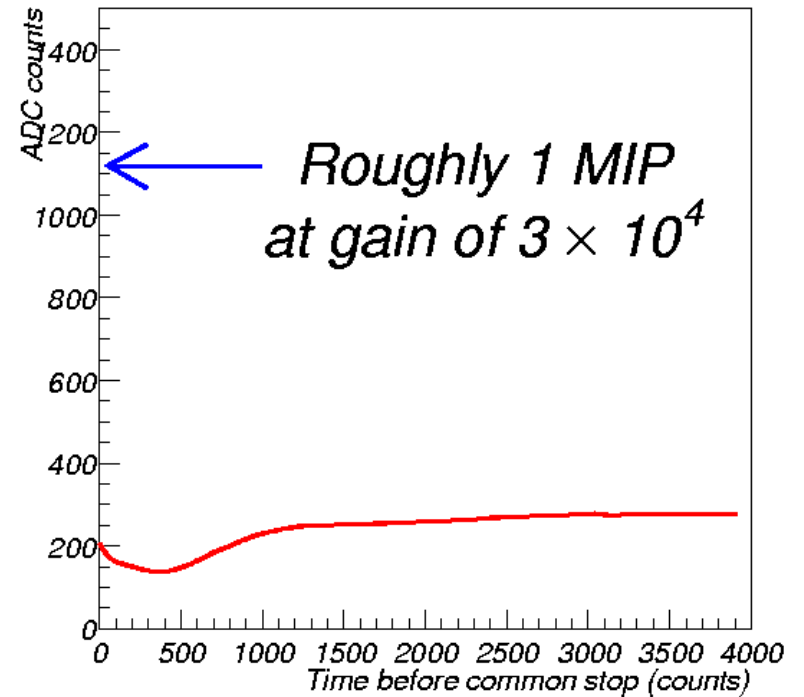
$$f(d) = \beta(1 + \gamma e^{-(t/\tau)})t$$

B-physics meeting

# Status of T0F detector



TAC calibrations stability

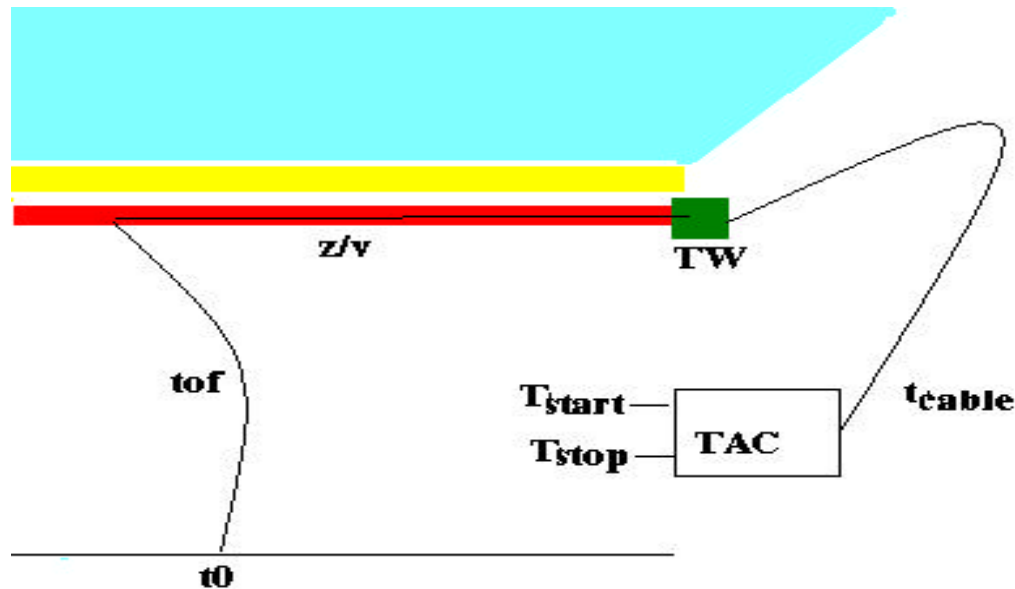


Pedestal time dependence

# Status of T0F detector

- Electronics: everything is in place and working.....except:
  - One channel had HV trips.
  - One tube dynode touch.
- TAC calibrations are done, online consumer not finished
- TOF readout in **TOFD** banks, contain:
  - Data: TDC and ADC counts
  - Calib: +ADC pedestals
- TOFD are read by the offline to reconstruct the TOF information
- Ongoing studies: occupancy, efficiencies, gain stability, trigger path dependencies etc.

# Calibrations



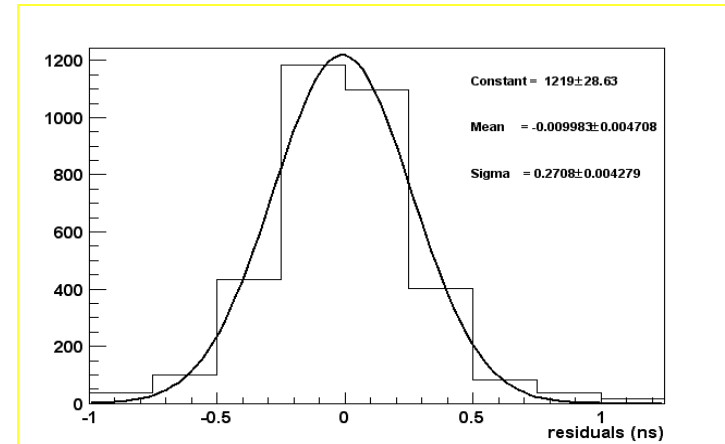
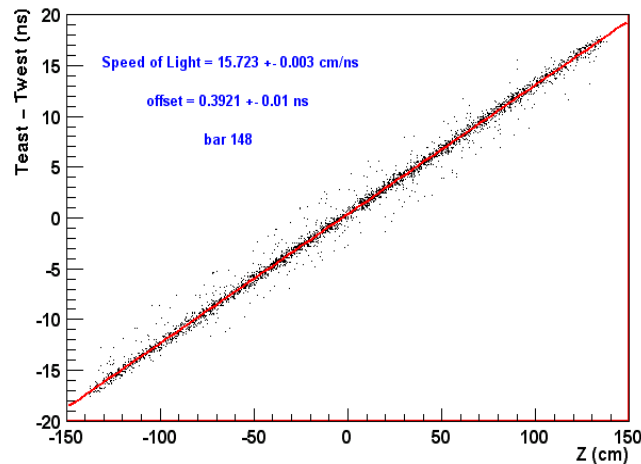
- Offline corrections are essential to get the 100 ps
- The time is measured backwards:

$$TDC_{ch} = T_{stop} - T_{start}$$

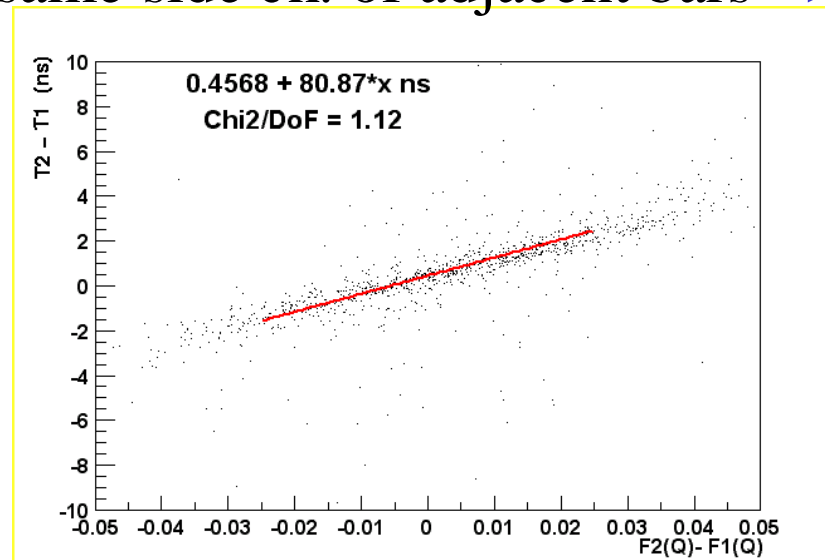
- Main problem **event**  $t_0 \Rightarrow$  Need to bypass it to get constants
- Requires reasonably good tracking

# Calibrations

- Time difference ( $\Delta T$ ) between channels of same bar  $\Rightarrow$  speed of light



- $\Delta T$  between same side ch. of adjacent bars  $\Rightarrow$  Slewing correction



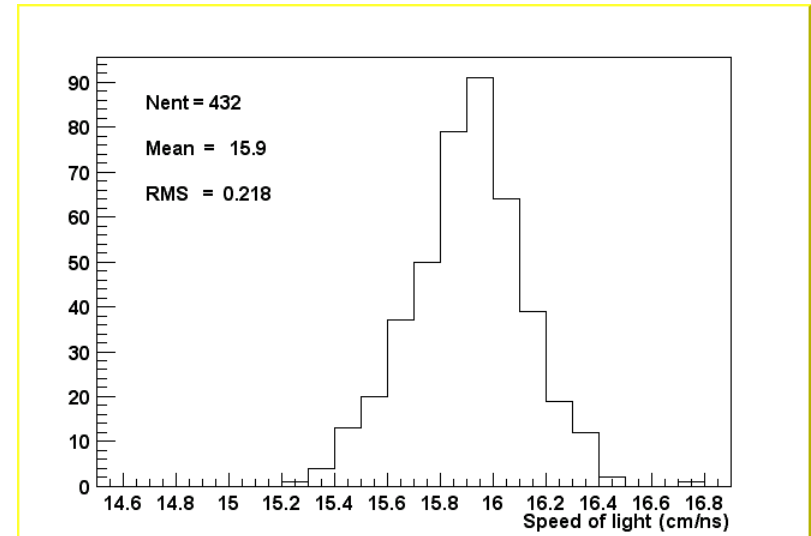
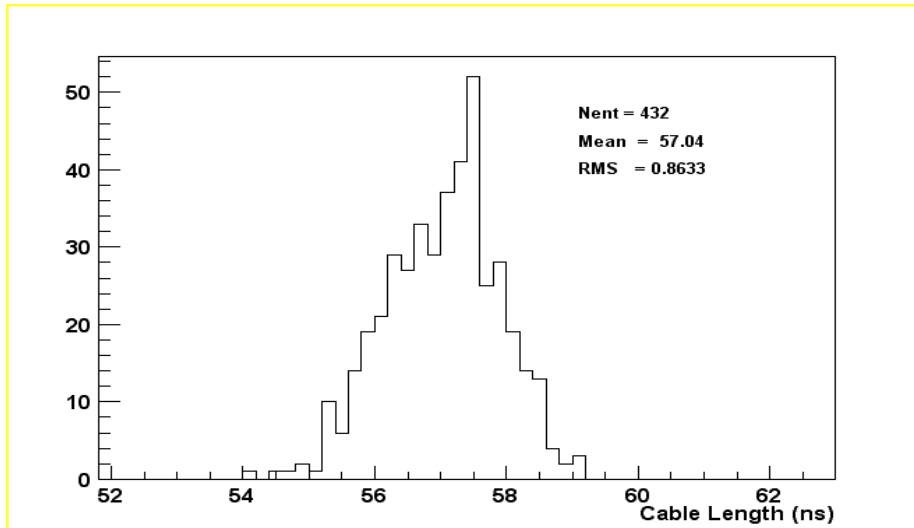
April 4, 2002

B-physics meeting

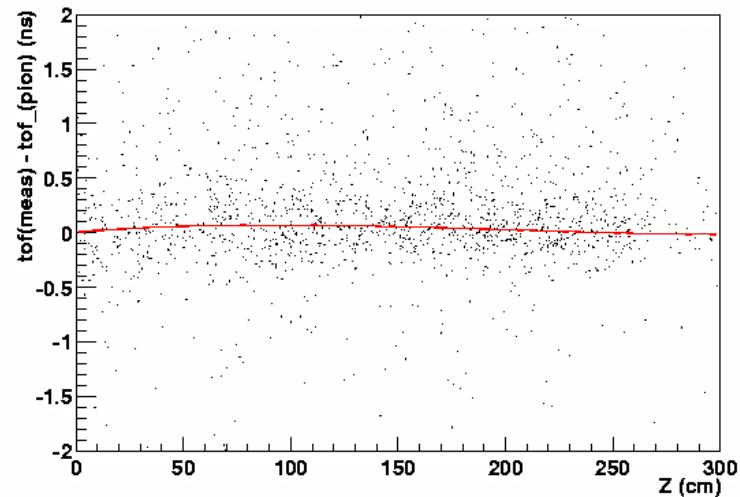


# Calibrations

- Cable Lengths and speed of light per channel



- Residual correction with z position.



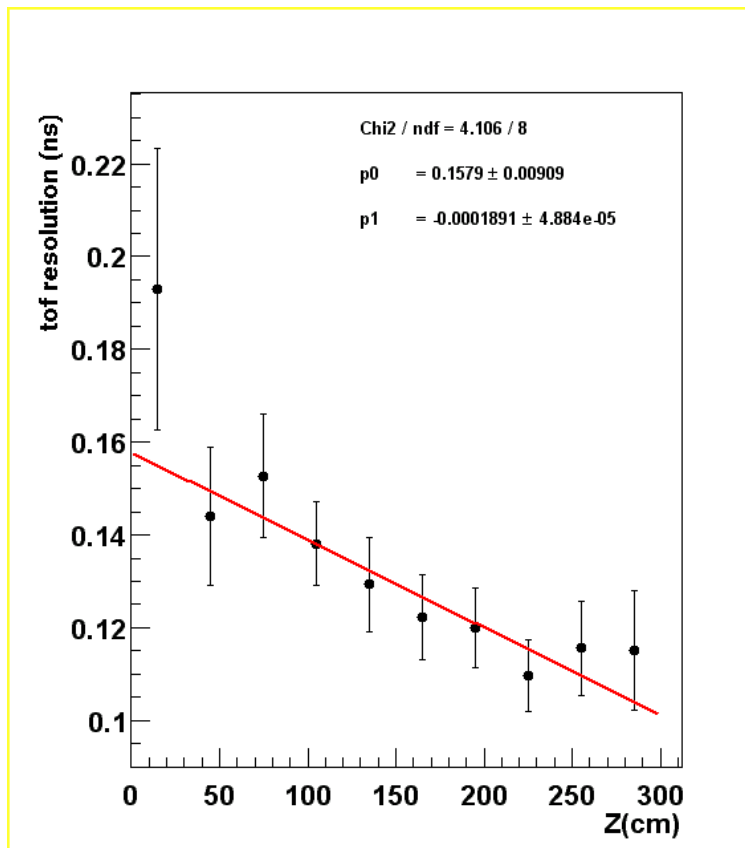
April 4, 2002

B-physics meeting

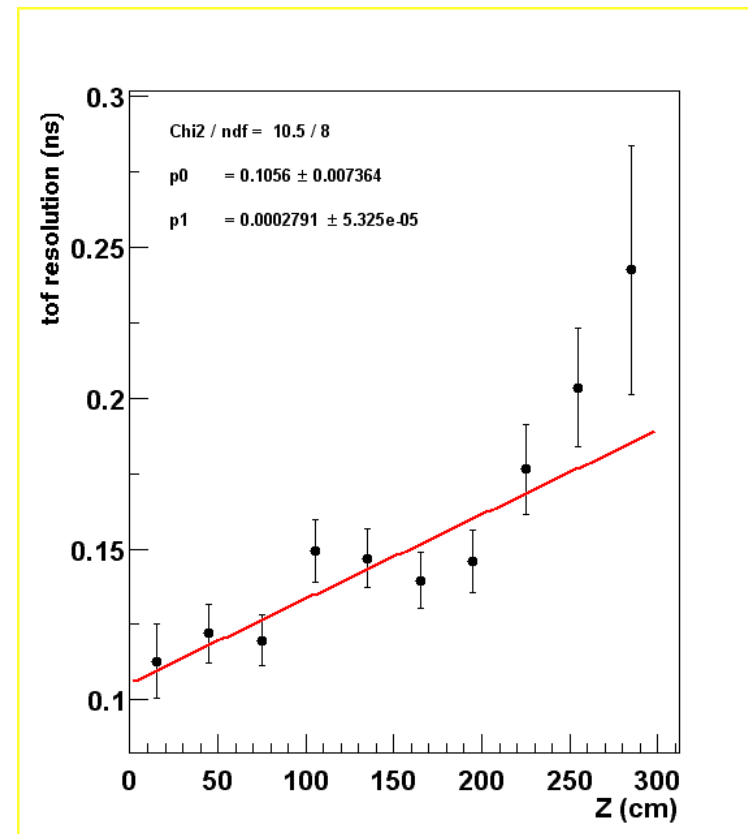
# Resolutions

- PMT **resolutions** for tof as function of Z position:

East side



West side

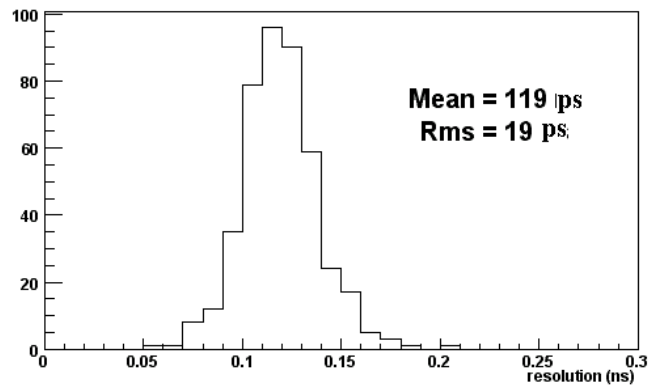


April 4, 2002

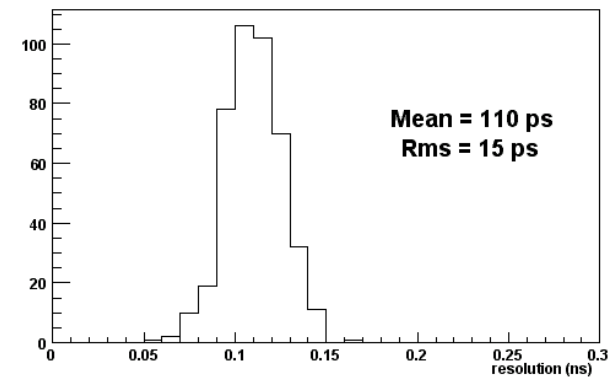
B-physics meeting

# Resolutions

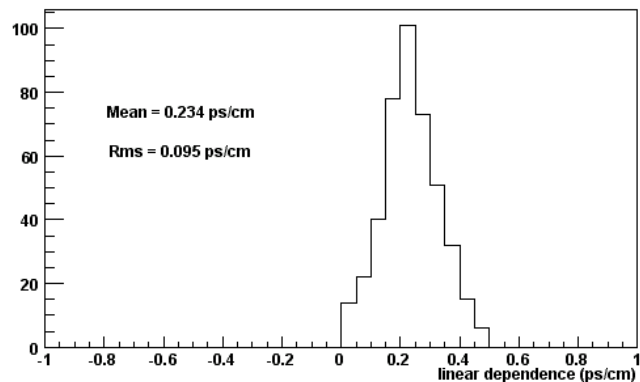
tof resolution at pmt, without  
Z- dependence correction:



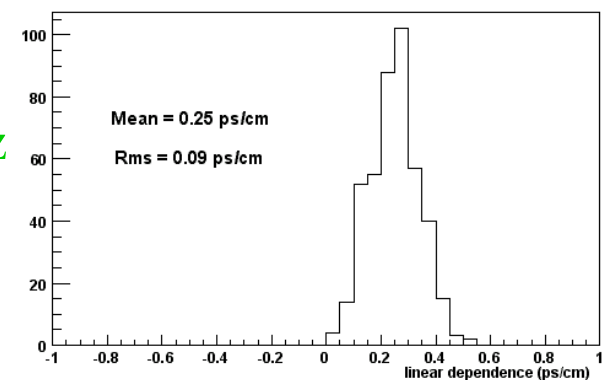
tof resolution at pmt, with  
Z- dependence correction



Resolutions  
At PMT



Dependence with z

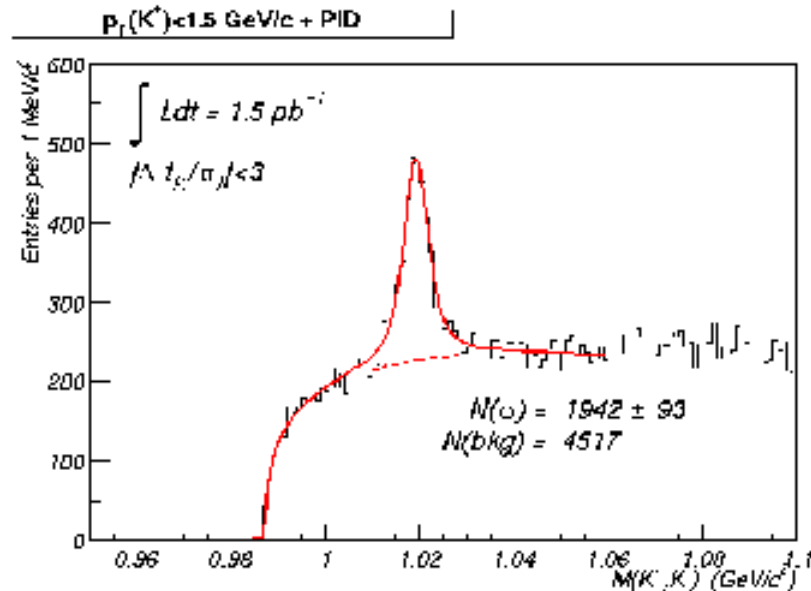
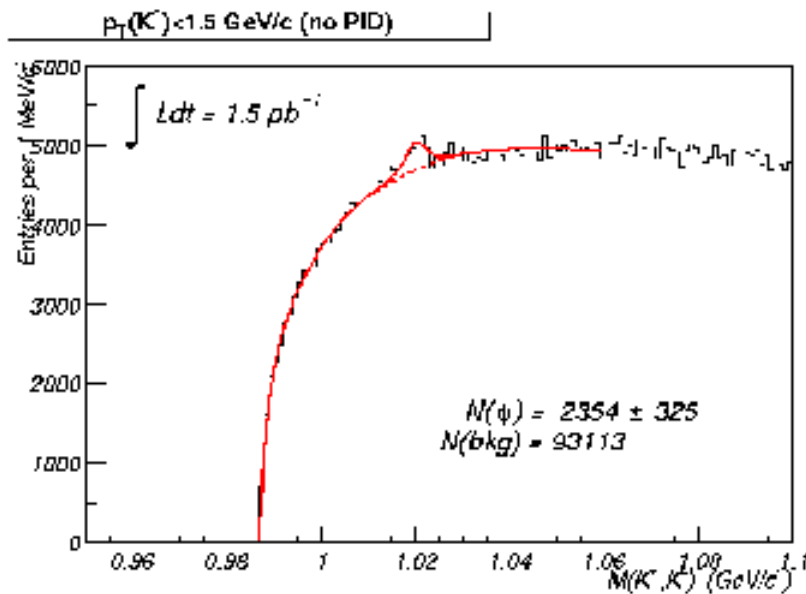


April 4, 2002

B-physics meeting

# Particle ID with TOF

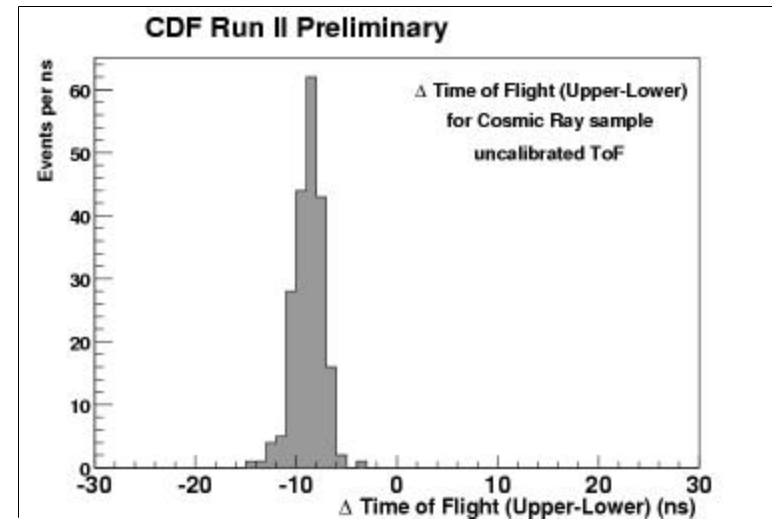
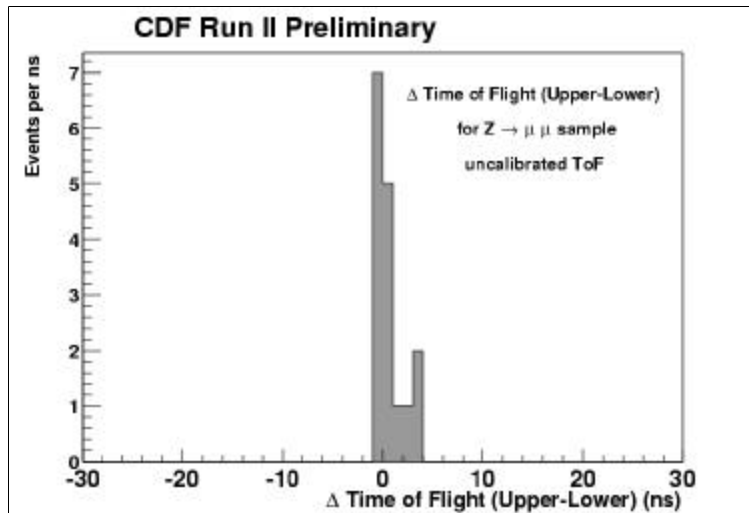
Particle ID plots:  $\Phi(1020)$  from Kaons with  $P_t < 1.5$  GeV/c



- $p_T$  of both tracks between 0.4 and 1.5 GeV/c
- Minimum COT hits: 20 axial, 20 stereo
- Minimum silicon hits: 2 r-phi hits
- Impact parameter less than 1 mm with respect to beam line
- Both tracks in same vertex used to calculate the event  $t_0$

# Other Uses of the TOF

- Cosmic Rejection



- CHAMP (Charge heavy massive particles)
- TOF trigger (functioning in a month scale):
  - HIP trigger
  - MIP multiplicity
  - Cosmic trigger

## Conclusions:

- The electronics are in place,  $\sigma_t < 25$  ps
- Everything is working fine (“problems” of the order of 2 channels out 432)
- Offline correction essential (constants are in DB and soon will be created auto.)
- 100 ps seems achievable
  - bit more work on correction: refine algorithms
  - further exploit of hardware: ADC gate, HV, discriminator thresholds
- Other studies are on their way :
  - Offline correction stability
  - Occupancy ( maybe concerns-> can't handle multiple hits)
  - Efficiencies of the track matching algorithm
  - TOF Simulation

➤ **NEXT Ivan's talk for the offline**